DOCUMENT RESUME

ED 337 747 CS 010 716

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TITLE The Enactment of Literacy in High School Biology Classrooms: Two Case Studies.
PUB DATE Dec 90
NOTE 16p.; Paper presented at the Annual Meeting of the National Reading Conference (40th, Miami, FL, November 27-December 1, 1990).
PUB TYPE Speeches/Conference Papers (150) -- Reports - Research/Technical (143)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Biology; Case Studies; Classroom Environment; Classroom Research; High Schools; *Literacy; *Science Instruction; Secondary School Science; *Teacher Behavior; Teacher Student Relationship; Writing Instruction

ABSTRACT

As part of a larger examination of teaching and learning within the social context of high school biology classrooms, a case study examined the enactment of literacy events as social processes in two high school biology classrooms. Two veteran high school biology teachers in an urban high school used identical first-year biology textbooks and basic curricula. The teachers differed drastically in their beliefs and behaviors concerning science instruction. Students of the first teacher were 10th to 12th graders taking their first science course, while students of the other teacher were all 9th graders and likely to continue with other science classes in high school. Data collection occurred over a 7-week period and included field notes of observations of teacher behavior, audiotapes of classroom talk, students' verbal and nonverbal behaviors, and formal and informal interviews with students. Results indicated that: (1) teachers' beliefs about teaching and learning science were the driving force in the classrooms, not the textbook; (2) reading was enacted differently in the classrooms; (3) teachers' beliefs about the relationship between learning and writing affected the types of writing tasks students engaged in; (4) the nature of the interactions as well as the types of tasks in each classroom defined the nature of learning; and (5) the culture of each classroom demonstrated the influence and beliefs of the participants. Findings suggest that students in the two classroom contexts were gaining access to very different types of literacies. (Sixteen references are attached.) (RS)

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Running Head: THE ENACTMENT OF LITERACY

Paper presented at the 40th Annual Meeting of the National Reading Conference, Miami Beach, December 1990.

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The Enactment of Literacy in High School Biology Classrooms: Two Case Studies

In recent years, researchers concerned with literacy issues have moved from the laboratory to the "real worlds" of the classroom, the homes, the community, and the workplace (Bloome, 1987a). These types of examinations take the perspective that literacy is a social process.

Bloome (1987c) describes three categories of reading research that are concerned with its social process. One category considers reading within a social/communicative context. Salient issues in this category include the opportunities to gain access to literacy events, and the nature of those opportunities. A second category focuses on the social uses of literacy. Studies within this category are concerned with the interplay between what counts as reading and writing and the situation. Studies examining reading as a sociocognitive process form the third category. These are concerned with the nature of literacy as "a process of socialization, enculturation, and cognition" (Bloome, 1987c, p. 126).

Bloome's heuristic provides a framework to examine how literacy events are enacted classrooms, and how these enactments affect student learning. Within this framework, classrooms have their own culture, and that culture is shaped by the participants (Bloome, 1987c; Green & Weade, in press).

However, little of the work concerned with literacy as a social process has examined the nature of literacy at the level

of secondary schools. The need for this examination was exemplified by a conference in 1984 at the University of Michigan that focused on this topic. [See Bloome (1987b) for a collection of papers from that conference.]

In particular, very little work has been done which describes how literacy is enacted in secondary science classrooms from this perspective. These understandings are especially important as science education is criticized for its production of scientifically illiterate students (Mullis & Jenkins, 1988; National Science Foundation & Department of Education, 1980).

The research reported here comes from a larger study designed to examine teaching and learning within the social context of high school biology classrooms. The purpose of this paper is to examine the enactment of literacy events as social processes within the contexts of these classrooms.

Method

Research Setting

This study took place in two biology classrooms, each taught by a different teacher, in one urban high school. The curriculum specialist selected the two teachers, describing them as "volunteers" and "interesting teachers." He thought that they would provide an "interesting contrast" for my study. Both teachers have had many years' experience teaching biology. I later learned that he and the principal had a hidden agenda in their selection of teachers, namely that they hoped my presence would motivate one of the teachers to change.

These two classrooms represented parallel classes. Each was a first year biology course using the same textbook and the same basic curriculum, which had been determined by the school district. This was the first year that these teachers (and this district) had used this particular textbook.

The student populations in these two classrooms differed. The students in Larry's (all names have been changed) class were 10th-12th graders taking their first science class. Because they had put off their science requirement, they were unlikely to take anymore science in high school. Ed's students were 9th graders. Though not all of them would continue with other science classes in high school, they had more of an opportunity to do so by taking a science class in their freshman year, and were described as likely to do so.

Research Procedures

Two research assistants and I were participant observers in these two classrooms over the same time period for 7 weeks in the spring semester. At that point, no new trends or themes had emerged (Bogdan & Biklen, 1982), and data collection was ended.

Data collection was designed to provide three perspectives of these classrooms: that of the observer, the teacher, and a sample of students. Each research assistant was assigned to one of the classrooms, collecting field notes of teacher behaviors and audiotapes of classroom talk. Later, each combined these two data sources into one transcription for each daily observation.

I collected data from a sample of students in each class.

Two students were observed extensively in Ed's classroom, and four were observed in Larry's. The sample students represented both successful and unsuccessful students in each class, as identified by their teacher. The data collected on these students included their verbal and nonverbal behaviors, audiotaped informal interviews about their understandings and strategies related to the tasks in which they were engaged, and copies of their written work.

Periodically, I informally interviewed teachers about a day's lesson. I asked questions about the purposes of the tasks, their notions of biology teaching and learning related to the lesson, the rationale and effects of the participatory structures, and their sense of student understanding of ideas.

I also conducted formal interviews of both teachers and target students. Students were formally interviewed about their content knowledge at the end of two units. Additionally, they were interviewed at the end of the project about biology in general, their classroom, and their learning. Formal teacher interviews about their beliefs about teaching, learning, students, and biology were also conducted at this time.

Because the researcher was a participant observer throughout the project, some categories of analysis were identified during data collection (Bogdan & Biklen, 1982). Other categories of analysis emerged from the data after completion of the study using the constant comparative method (Glaser & Strauss, 1967). These categories are reflected in the results.

Internal validity of the findings was achieved through the triangulation of data sources, and through the recurring patterns across days.

Results

There were five major findings that reflect how literacy is enacted in these classrooms.

Finding 1. The textbook was not the driving force in these classrooms. Rather, each teacher's beliefs about teaching and about learning science impacted the function of the textbook in these classrooms. This is an important conclusion for at least two reasons. First, science educators have been criticized for their excessive reliance on science textbooks for both curriculum and instruction (Mayer, 1986). Second, reading researchers have described the effects of the difficulty of materials on the nature of instruction. For example, Barr (1987) describes how a high school English teacher altered instruction when the texts students read became more difficult.

In these two classrooms, both teachers used the same book. This textbook was very difficult, containing a dense concept load and a large number of technical vocabulary. Borrowing Blystone's (1987) characterization of science textbooks, this book was encyclopedic.

The textbook in Larry's classroom <u>was</u> the curriculum. Virtually all classroom tasks were text reproduction (Bloome, 1987c) tasks. Lectures retold each chapter, students' notes were supposed to summarize the text, and students were given

publisher's workbooks on vocabulary and concepts at the end of each chapter. All tests had been written by the publisher, with most questions asking for further restatements of the text-based ideas and vocabulary. Though this description of how Larry uses the textbook exemplifies those classrooms which have been criticized by science educators, it is important to understand why this occurs if effective changes can be made.

Larry talked about the book as being complex, and about how he deleted some test questions he thought were "too picky". He also described omitting chapters because he couldn't cover all the content in one year. In addition to these decisions, he also thought he was addressing the difficulty of learning from this complex text by asking students to engage in the tasks described above. In this way, they would have numerous interactions with the same ideas, and through repetition would eventually learn them.

In Larry's classroom, the textbook was like a black-out curtain encasing the classroom interactions.

The textbook played a very different role in Ed's class. The book was both a topical guide and a reference book. Ed also recognized the dense concept and vocabulary load in this book. Though he also left out many ideas and technical vocabulary, it was not only because of this density, but because he didn't think many of these ideas were important for high school students to know. Because these ideas were so often the details of biology, he thought that students interested in them would continue their

biology education in college.

The substance of the class, rather than coming from the textbook, came from both Ed's and the students' experiences. Though pictures and/or introductions to chapters may begin a lesson in Ed's class, he had worked for many weeks at the beginning of the year to encourage students to talk about their related experiences and to ask questions about the ideas. He modeled this constantly by sharing anecdotes about himself, his friends, and his family related to the topic.

In Ed's classroom, the textbook was like a thin gossamer curtain, with teacher and student ideas easily filtering through like sunlight.

Finding 2. Reading was supposed to be for understanding, but that didn't always happen. The classroom interactions and tasks define what reading is (Bloome, 1987a), and reading was enacted differently in these classrooms.

Larry's students were expected to read the text to encounter the material they'd heard in lecture one more time. This repetition was supposed to help them learn. Their preparation for reading was the lecture. While reading, they were expected to take notes. During Larry's lectures, he made some attempt to connect the text ideas with their own knowledge, but it was in the form of a quiz. For example, he would ask them questions about the function of a specific structure in an animal, rather than ask about their experiences related to the topic. Success was measured by their scores on vocabulary workbook pages, pages

of notes taken, and scores on tests.

The students in Ed's class were expected to read portions of the text for purposes set by the teacher. For example, when beginning a new unit on an animal group, students would read and copy the characteristics from their book. Before a test, Ed would go through the chapter, telling students which ideas they were responsible for.

There were many opportunities to use the textbook in Ed's class in conjunction with labs. Students were often asked questions as part of their lab work. Many of these questions required a knowledge base they could gain from their texts. Typically, these questions were textually implicit.

In Ed's class, the ideas in the textbook were enmeshed within the classroom discussions and labs. Success in understanding in this classroom was more global than any measure of textbook reading comprehension.

Finding 3. Teachers' beliefs about the relationship between learning and writing affected the types of writing tasks students engaged in.

The students in Larry's class were required to do the kinds of writing that has been described by Applebee (1981) as typical of secondary classroom writing tasks. Much of it was fill-in and short answer as students completed workbook pages. Longer discourse consisted of some type of textbook restatement. In fact, one student, knowing that the volume of textbook notes was important, began to copy the textbook in his notebook. These

notebooks were also supposed to contain any notes the teacher had written on the board. Though students were required to write during labs, little of this writing required any synthesis of ideas.

As stated previously, Larry had a rationale for these types of activities. These various writing tasks, he thought, would help students learn through more exposure to the ideas. To him, what was important in learning was giving students the opportunity to encounter the same ideas in different ways: reading, listening, writing.

Ed had a different belief about writing. This was especially apparent from his discussion of student lab write-ups. He required students to write a summary section in their lab reports that was to connect the purpose, their hypotheses, and their results. This was their opportunity to synthesize ideas, and to explain why the lab did or did not work.

Finding 4. The nature of the interactions as well as the types of tasks in each classroom defined the nature of learning.

In Larry's class, learning was defined by being able to give correct answers during recitation, reproduce textbook ideas in a notebook, and get the correct answers on written work. Larry did not think that students could learn well while working together. He was uncomfortable when students worked with partners during labs. He thought that students would divide the tasks, and only learn the parts they had done. He did not think about the possibility of altering the tasks so that interaction between

students would actually enhance learning.

Ed's class again provides a contrast. Learning was defined by students' interaction with ideas. This was apparent when Ed encouraged students to bring their experiences and questions into class discussions. This was also apparent during labs. There were at least two factors during the labs which affected the learning environment. The first was the type of labs he assigned. These often had components which required students to go beyond surface level ideas. The second factor was the general context Ed had orchestrated in his class. Students had become accustomed to sharing ideas during discussion. During labs, these types of interactions were extended so that students helped each other solve problems, answer questions, and do procedures correctly.

Finding 5. The culture of each classroom demonstrated the influence and beliefs of the participants.

Larry's class was dominated by the teacher. Though he talked about being concerned for the students both as individuals and as learners (and I have no doubt that he was concerned), his actions as a teacher rarely displayed these considerations. Most tasks were centered around the content, rather than around student understandings, questions, or purposes. During my study, students displayed a lot of passive resistance. Many students wrote notes to one another, put their heads down on their desks, and wrote their textbook notes during lecture time. Several students, during times I interviewed them about the tasks they

were doing, spontaneously told me how they wanted the class to be changed. They wanted Larry to let them work together more often so that they could learn from each other. They wanted to be able to review for exams together, asking each other questions. And they wanted more opportunities for labs, tasks which do allow them to work with their classmates.

Ed's class represented a very different culture. Sharing ideas, control of content, and procedural knowledge was characteristic of most of the classes we observed. The exception was the way authority about content knowledge was defined. Typically, when students asked a question, Ed would answer without giving other students an opportunity to respond. Otherwise, this class displayed many instances of both teacher and students providing scaffolding for student learning (Vygotsky, 1978).

Conclusions

Though I have described these classrooms through these categories, there is obvious overlap between them. These overlaps emphasize the need to examine the complexities of literacy enactments in classrooms when trying to explain and/or change them.

An example of a simplistic solution in biology education was the altering of textbooks. It was thought that since teachers adhered to textbooks, then changing the textbooks might help student learning. A new curriculum, Biological Sciences Curriculum Study (BSCS) was developed, but did not meet its

intended expectations (Mayer, 1986).

Teacher's beliefs about teaching, students and their subject area are important considerations when describing classroom contexts. Teachers have reasons for the ways in which they behave. To effectively alter those behaviors when students are adversely affected requires more than presenting new classroom strategies. Teachers need opportunities to verbalize those beliefs, examine them, and consider them within the contexts of their classrooms and perhaps research (Richardson, 1990).

One nagging concern cloaked my perceptions of these classrooms, and that was my concern with students' access to literacy opportunities. First, I was concerned about the effects of students' opportunities for literacy by virtue of which teacher they are assigned to. From the obvious differences between these two classroom contexts, students were gaining access to very different types of literacies depending on which class they were in. A second cause for this concern was prompted by differences in the student populations in each class. Aside from grade level differences and the implications about their continued studies in science, Larry's class also had many more minority students than Ed's. Others (Guthrie & Leventhal, 1985) have documented differential opportunities for scientific literacy within high school student populations based on many different factors. More needs to be learned about the grouping of the students in this research site.

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